

### Calculus Warm Up # 6-5

For what values of  $x$  will the function fail to be differentiable?

1)  $f(x) = |x-2|$       2)  $f(x) = 5x^{2/3}$       3)  $f(x) = \sqrt[5]{x+5}$

4)  $f(x) = \sqrt{x^2 - 4x + 4}$       5)  $f(x) = 1 + \sqrt[3]{\sin x}$

HW Questions: p. 335

5. A force of 5 pounds compresses a 15-inch spring a total of 4 inches. How much work is done in compressing the spring 7 inches?

$k = \frac{5}{4}$  from

6. How much work is done in compressing the spring in Exercise 5 from a length of 10 inches to a length of 6 inches?

$\frac{35}{12}$  ft-lbs.

$$W = \int_0^9 \frac{5}{4} x dx - \int_0^5 \frac{5}{4} x dx = \int_5^9 \frac{5}{4} x dx$$

7. A force of 60 pounds stretches a spring 1 foot. How much work is done in stretching the spring from 9 inches to 15 inches?

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8. A force of 200 pounds stretches a spring 2 feet on a mechanical device for driving fence posts. Find the work done in stretching the spring the required 2 feet.

200 ft-lbs.

9. A force of 15 pounds stretches a spring 6 inches in an exercise machine. Find the work done in stretching the spring 1 foot from its natural position.

10. An overhead garage door has two springs, one on each side of the door. A force of 15 pounds is required to stretch each spring 1 foot. Because of the pulley system, the springs only stretch one-half the distance the door travels. Find the work done by the pair of springs if the door moves a total of 8 feet and the springs are at their natural length when the door is open.

240 ft-lbs.

$$F(x) = 15x$$

$$W = 2 \int_0^4 15x \, dx$$

Answers: purple WS

1)  $336,960\pi$  ft-lbs.

2)  $7200$  ft-lbs.

3)  $14,592\pi$  ft-lbs.

4)  $4,243.2\pi$  ft-lbs.

5)  $\approx 94,012.2$  ft-lbs.

Classwork: (purple)

AP Calculus AB

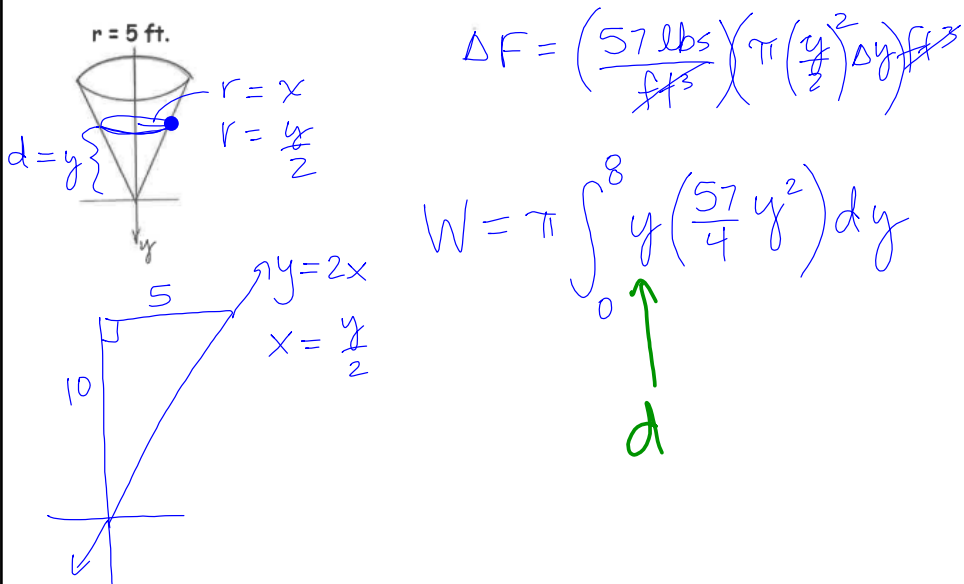
Name \_\_\_\_\_

6.5 Work to move liquid

1. A cylindrical tank is half full of water. The tank has a radius of 6 ft. and is 20 ft. tall. How much work is done pumping all the water out the top of the tank? (Water weighs  $62.4 \text{ lbs/ft}^3$ ).

2. A 9 ft. tall rectangular tank with a base 8 ft. by 2 ft. is full of molasses. How much work is done to pump one third of the molasses out the top? (Molasses weighs 100 lbs/ft<sup>3</sup>).

3. A 10 ft. tall conical tank is used to store olive oil. How much work is done filling the tank up to 2 ft. from the top through a hole in the bottom of the tank? (Olive oil weighs 57 lbs/ft<sup>3</sup>).

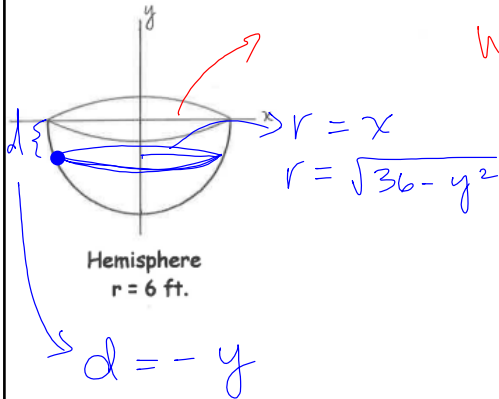


$$\Delta F = \left( \frac{57 \text{ lbs}}{\text{ft}^3} \right) \left( \pi \left( \frac{y}{2} \right)^2 \Delta y \right) \text{ ft}^3$$

$$W = \pi \int_0^8 y \left( \frac{57}{4} y^2 \right) dy$$

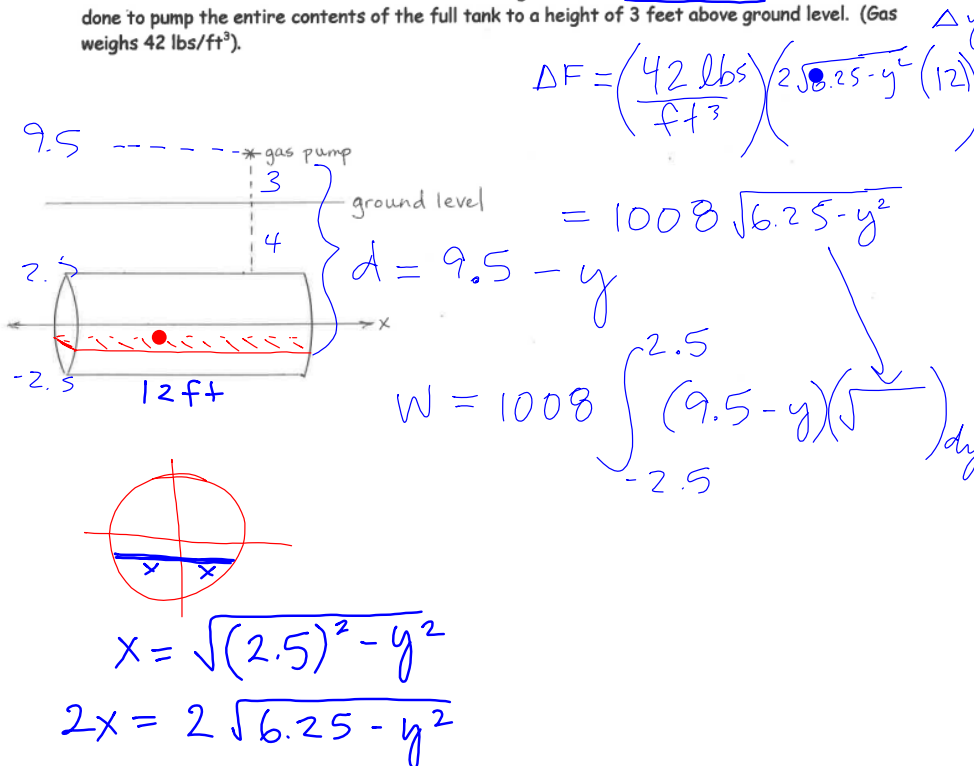
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4. How much work is done pumping out the top 2 ft. of water through a hole in the top of the tank?  
(Water weighs 62.4 lbs/ft<sup>3</sup>)



$$W = \int_{-2}^0 (-y) \left( 62.4 \pi (\sqrt{36 - y^2})^2 \right) dy$$

5. The top of a cylindrical storage tank for gasoline at a service station is 4 feet below ground level. The axis of the tank is horizontal and the 12 ft. long tank has a diameter of 5 ft. Find the work done to pump the entire contents of the full tank to a height of 3 feet above ground level. (Gas weighs 42 lbs/ft<sup>3</sup>).



Week 6 Classwork:

Warm up on top

Yellow Volume Review

Purple Work to move Liquid

HW:

Ch. 6 Review WS #1  
(tan)

Last Ch. 6 section: 6.6 on Monday

Test: next Thursday, Feb. 1